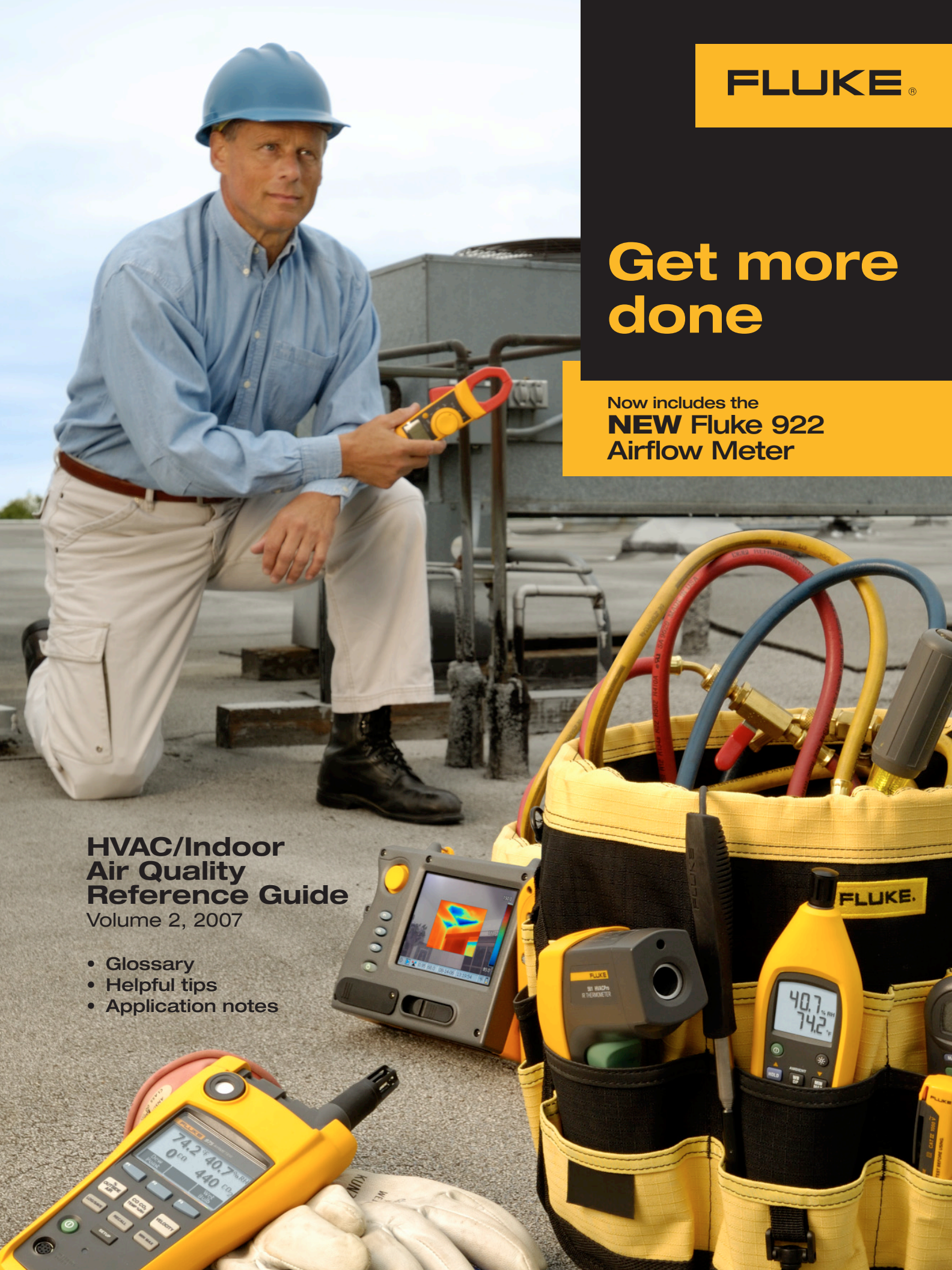
FLUKE®

Get more done

Now includes the
NEW Fluke 922
Airflow Meter



HVAC/Indoor Air Quality Reference Guide

Volume 2, 2007

- Glossary
- Helpful tips
- Application notes

HVAC/Indoor Air Quality
Selection Guide

	Air Composition						Thermal Imaging	
Model	**983 Particle Counter**	**975 AirMeter™**	**922 Airflow Meter**	**CO-220 CO Detector**	**CO-210 CO Probe[1]**	**971 Temperature Humidity Meter**	**TiR Series Thermal Imagers***	**IR-InSight Infrared Imagers***
Description	Measure six particle sizes simultaneously	Measure temperature, humidity, CO_2, CO, Velocity with one tool	Combines air pressure, velocity and flow into one rugged, easy-to-use meter	Quickly test CO levels	Conveniently measure CO with this DMM accessory	Measure humidity faster, calculate wet bulb and dew point temperatures	Provides fast and easy precision temperature measurements	Low contrast thermal application imager
Page Number	4	6	8	9	9	10	11	12
Measurements								
Particle size	0.3, 0.5, 1.0, 2.0, 5.0, 10.0 µm							
Temperature	+40 °C (104 °F)	+50 °C (122 °F)	+50 °C (122 °F)			+60 °C (140 °F)	+600 °C (1112 °F)	+100 °C (212 °F)
Air velocity		50 fpm to 3000 fpm, 0.25 m/sec to 15 m/sec	250 fpm to 16,000 fpm, 1 m/sec to 80 m/sec					
CO_2		5000 ppm						
CO		500 ppm		0 to 999 ppm	0 to 1000 ppm			
Optical resolution								
Relative humidity	20 % to 90 %	10 % to 90 %				5 % to 95 %		
Vacuum								
Pressure			± 4000 Pascals ± 16 in H_20 ± 400 mm H_20 ± 40 mbar ± 0.6 PSI					
Voltage ac/dc								
Current ac/dc								
Resistance								
Frequency								
Capacitance								
Conductance								
Data storage								
Data logging	5000 readings	99 readings (discrete), 25,000 readings (continuous)	99 readings			99 readings		
Min/Max/Avg		Yes/Yes/Yes	Yes/Yes/Yes	No/Yes/No		Yes/Yes/Yes		
Display Hold/ Auto (Touch) Hold			Yes/No	Yes/No		Yes/No		

(1) Accessory for use with a digital multimeter with dc millivolt inputs.

IR Temperature		TC Temperature		Pressure		HVAC Electrical Tools		
561 HVACPro IR Thermometer	**62 Mini IR Thermometer**	**54 TC Thermometer**	**80PK-8 TC Clamp[1]**	**PV350 Pressure/Vac[1]**	**1AC II VoltAlert Voltage Detector**	**902 True-rms HVAC Clamp Meter**	**116 HVAC Multimeter**	**1587 Insulation Multimeter**
Contact and non-contact temperature in one	Best accuracy in its class, perfect introduction to IR thermometers	Dual-temperature for ΔT across furnaces and coils	DMM accessory captures liquid and suction line temperatures	DMM accessory captures liquid and suction line pressure values	Non-contact voltage with audio alarm	Designed for HVAC, with temperature, dc microamps and capacitance	Basic DMM built for HVAC technicians	Insulation tester and true-rms digital multimeter in one
14	15	18	18	19	20	21	22	23
+550 °C (1022 °F)	+500 °C (932 °F)	+1767 °C (3212 °F) J, K, T, E, N, R, S	+149 °C (300 °F)			+400 °C (752 °F) K	+400 °C (752 °F) K	+537 °C (998 °F) K
12:1	10:1							
				76 cm Hg (406.7 in H_2O)				
				3447 kPa (499.9 psi)				
					600 V ac	600 V	600 V, 600 mV	1000 V
						600 A/200 µA	600 µA	400 mA
						9999 Ω	40 MΩ	50 MΩ
							50 kHz	100 kHz
						1000 µF	9999 µF	999 µF
		500 readings						
Yes/Yes/No	No/Yes/No	Yes/Yes/Yes				Yes/Yes/No	Yes/Yes/Yes	Yes/Yes/No
Yes/No	Yes/No					Yes/No	Yes/No	No/No

***Multiple models available to suit your specific needs. See www.fluke.com for more information.**

Particle Counter

Fluke 983 Particle Counter
Troubleshoot and maintain indoor air quality.

The new Fluke 983 Particle Counter, the preferred choice for HVAC and IAQ professionals, measures temperature and relative humidity as well as particle size. With expanded data logging and six-channel particle size display, the Fluke 983 allows users to run more tests quickly, with less time spent cycling through screens to obtain data. The Fluke 983 is lightweight and easy to use in any position, with a comfortable hand strap and rugged holster.

Use it to:

- Monitor HVAC filter efficiency
- Assess duct cleanliness per NADCA ACR 2006 Particle Profiling procedure
- Verify compliance to cleanroom standards
- Locate particle sources and report back on post-remediation conditions

The Fluke 983 Particle Counter offers:

- Selectable sample time, count data, and programmable delay
- User-defined sample size (cubic feet or liters) and temperature measurements (°C or °F)
- Data displayed in totalize or concentration modes
- Logged samples include date, time, particle counts, sample volume, temperature, and relative humidity

Quick Tips

Particle counts

Particle counts vary according to a number of factors such as location, time of year, and occupants. When taking particle counts, always establish an outside baseline reading to compare indoor particle levels against. Ideally, indoor particle levels will be less then outdoor levels.

Filter bypass

When testing for filter bypass, take particle counts before and after sealing the edges of the filter with duct tape. This will provide an indication of how much particulate matter is bypassing the filter due to poor fitment or compromised sealing surfaces.

Fluke TP120 Thermal Printer Kit includes:

- Thermal printer
- (2) rolls paper
- Battery pack
- Serial adapter

Ordering information

Fluke-983 Particle Counter

Includes: Certificate of Calibration (NIST), Windows-compatible software download utility, DB9 to RS-232 adapter and cable, Isokinetic probe, zero count filter, high purity tubing, 1/8 in. hose barb adapter, power supply, hard molded plastic case, and users manual

Class		Number of Particles per Cubic Meter by Micrometer Size						
Federal Std 209E		ISO 14644	0.1 µm	0.2 µm	0.3 µm	0.5 µm	1 µm	5 µm
		ISO 1	10	2				
		ISO 2	100	24	10	4		
1	M1.5	ISO 3	1,000	237	102	35	8	
10	M2.5	ISO 4	10,000	2,370	1,020	352	83	
100	M3.5	ISO 5	100,000	23,700	10,200	3,520	832	29
1,000	M4.5	ISO 6	1,000,000	237,000	102,000	35,200	8,320	293
10,000	M5.5	ISO 7				352,000	83,200	2,930
100,000	M6.5	ISO 8				3,520,000	832,000	29,300
		ISO 9				35,200,000	8,320,000	293,000

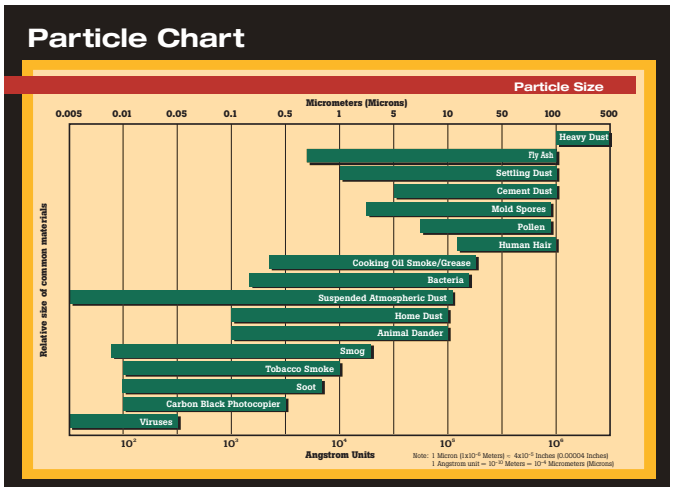
Summary of cleanroom classification standards

Cleanroom particle concentrations

The above table presents airborne particle limits for cleanroom applications per Federal Std 209E and ISO 14644 standards. The number of particles per cubic meter represent the maximum concentration limits for particles equal to and larger than the size tested for. For example, an ISO class 5 cleanroom certified at 0.3 microns should have no more than 10,200 particles 0.3 microns and larger. There are other requirements regarding sample volumes, locations and procedures that must be adhered to. Refer to the applicable cleanroom standard for more information.

Summary specifications

Feature	Description
6 size channels	0.3, 0.5, 1.0, 2.0, 5.0, 10.0 µm
Flow rate	0.1 cfm (2.83 L/min) controlled by internal pump
Count modes	Concentration, totalize, audio
Counting efficiency	50 % @ 0.3 µm; 100 % for particles > 0.45 µm (per JIS B9921:1997)
Zero count	1 count/5 minute (JIS B9921:1997)
Coincidence loss	5 % at 2,000,000 particles per ft
Relative humidity	± 7 %, 20 % to 90 % non-condensing
Temperature	± 3 °C, 10 °C to 40 °C (50 °F to 104 °F)
Data storage	5000 sample records (rotating buffer) of date, time, counts, relative humidity, temperature, sample volumes, alarms, and label
Alarms	Counts, low battery, sensor fail
Delay time	0 to 24 hours
Sample inlet	Isokinetic probe
Interface	RS-232 and RS-485 via RJ-45
Environmental	**Operating:** 10 °C to 40 °C (50 °F to 104 °F), 20 % to 90 % relative humidity, non-condensing **Storage:** -10 °C to 50 °C (14 °F to 122 °F), up to 90 % relative humidity, non-condensing



Common airborne particles and their sizes.

For more product information and detailed specifications, go to www.fluke.com

Growing your business through indoor air quality particulate profiling

You've probably heard mold referred to as the "new asbestos" for HVAC/R. Concern about mold and its health effects is driving consumers to have their indoor air quality (IAQ) situation assessed and, if necessary, repaired.

If you're the contractor they call, keep in mind that mold isn't the only issue to consider when assessing the IAQ of a commercial building or residence. Many different kinds of particulates in a work or living environment can cause Sick Building Syndrome and aggravate allergy and respiratory conditions. Read a detailed application note on www.fluke.com/iaq

New

Fluke 975V

New! Fluke 975 AirMeter™
Five powerful tools in one!

The new Fluke 975 AirMeter test tool raises indoor air monitoring to the next level by combining five powerful tools in one rugged and easy-to-use handheld tool by measuring temperature, humidity, velocity, CO_2 and CO. The Fluke 975 AirMeter test tool makes indoor air quality testing easier and faster.

Use it to:

- Optimize HVAC system operation and manage energy costs
- Respond to comfort-related occupant calls
- Verify the operation of building HVAC control systems
- Monitor air flow and velocity (975V only)
- Test for dangerous carbon monoxide leaks
- Monitor and data log conditions, then download for further analysis

Features include:

- Simultaneously measures, logs, and displays temperature, humidity, CO_2, and CO on a bright, backlit LCD display
- One-touch air flow and velocity with available probe (975V only)
- Wet bulb and dew point temperature
- % of outside air calculation
- CO_2 and CO field calibration feature
- Self-test function at startup
- Auto-backlight
- Automatically compensates for barometric pressure changes
- Min/Max/Average on all measured and calculated readings
- Multi-language user interface
- Metric or standard units
- Audible and visual threshold alarms
- Extensive discrete or continuous data logging capacity, downloadable to PC via USB interface
- Keypad lock for security
- Included FlukeView Forms® software

Ordering information

Fluke-975 AirMeter

Fluke-975V AirMeter with Velocity

Includes: AA alkaline batteries (3), users manual (with safety information), calibration cap, hard carrying case, FlukeView™ Forms software, power adapter, international power plugs and air velocity probe (Fluke 975V only)

Optional accessories

Fluke-975CK AirMeter Calibration Kit

Includes: Zeroing and span gas, tubing, regulator, hard carrying case

Fluke-975VP AirMeter Velocity Probe

Using the velocity probe to check velocity within a duct.

Quick Tips

Frequent Calibration is Key

Frequent calibration of gas sensors is key to maintaining the accuracy and performance of the device. Both CO_2 and CO sensors can exhibit tendencies to drift over time due to environmental factors such as temperature, humidity, and pressure.

Fluke recommends monthly calibration of the CO sensor, and an annual calibration for CO_2 for optimum performance.

Fluke-975CK Calibration Kit

Summary specifications

Feature	Range	Display resolution	Accuracy
Measured specifications			
Temperature	-5 °F to 122 °F (-20 °C to 50 °C)	0.1 °F (0.1 °C)	± 0.9 °C/± 1.62 °F from 40 °C to 50 °C ± 0.5 °C/± 1.00 °F from 5 °C to 40 °C ± 1.1 °C/± 1.98 °F from -20 °C to 5 °C
Relative humidity	10 % to 90 % RH non-condensing	1 %	± 2 % RH (10 % RH to 90 % RH)
Air velocity	50 fpm to 3000 fpm 0.25 m/sec to 15 m/sec	1 fpm 0.001 m/sec	± 4 % or 4 fpm* ± 4 % or 0.02 m/sec* whichever is greater *Accuracy specification only valid for velocity readings above 50 fpm or 0.25 m/sec.
CO_2	0 to 5000 ppm	1 ppm	Warm up time 1 min (5 minutes for full specification) 2.75 % + 75 ppm
CO	0 to 500 ppm	1 ppm	± 5 % or ± 3 ppm, whichever is greater, @ 20 °C and 50 % RH
Calculated specifications			
Dew point temperature	-44 °C to 50 °C (-47 °F to 122 °F)	0.1 °C (0.1 °F)	± 1 °C when temp: -20 °C to 50 °C RH: 40 % to 90 % ± 2 °C when temp: -20 °C to 50 °C RH: 20 % to 40 % ± 4 °C when RH: 10 % to 20 %
Wet bulb temperature	-16 °C to 50 °C (3 °F to 122 °F)	0.1 °C (0.1 °F)	± 1.2 °C when RH: 20 % to 90 % temp: -20 °C to 50 °C ± 2.1 °C when RH: 10 % to 20 %
Volume flow rate (in a duct)		0.01 M3/min (1 cfm)	N/A The volume flow calculation will be a simple average of the data points times the duct area
% outside air (based on temperature)	0 to 100 %	0.1 %	N/A
% outside air (based on CO_2)	0 to 100 %	0.1 %	N/A

Technician using the 975 AirMeter to check for carbon monoxide leaks.

Making the numbers add up: Understanding specifications and performance of indoor air quality test instruments

Air quality test instruments must deliver accurate and verifiable performance, both to ensure precise and reliable air quality diagnosis, and to provide credible answers if results or procedures are challenged. The air quality professional's reputation depends on the quality and performance of the test tools in use, as well as on their understanding of instrument specifications, technologies, applications and maintenance.

Read more about indoor air parameters, the technology to measure them, and the importance of calibration to optimize performance and promote safety. Read a detailed application note on www.fluke.com/iaq

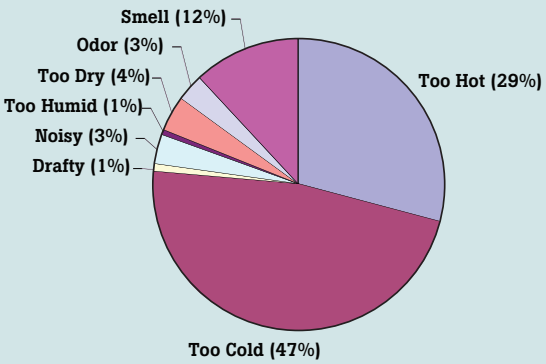
Measuring air velocity with the Fluke 975 Airmeter using the velocity probes

Air velocity is a key parameter in evaluating airflow system performance. As part of basic testing, adjusting and balancing of HVAC air distribution systems, technicians measure air velocity at grilles/registers/diffusers within a duct or in open space.

Read more about effectively measuring airflow and other IAQ and HVAC issues on www.fluke.com/iaq

Did You Know?

Common occupant complaints



Adapted from: Federspiel, C.C. 1998. Statistical Analysis of Unsolicited Thermal Sensation Complaints in Commercial Buildings. ASHRAE Transactions 104(1): 4, 8.

Just the facts:

- 77 % of occupant complaints are due to thermal conditions
- Technicians will take from 1.5 to 2 hours to respond to and diagnose those complaints

Fluke 975 helps technicians diagnose conditions quickly and with fewer tools. Do more. Carry less.

For more product information and detailed specifications, go to www.fluke.com

Airflow Meter

New! Fluke 922 Airflow Meter

Today's HVAC technicians want a simple solution for diagnosing ventilation issues. The Fluke 922 makes airflow measurements easy by combining pressure, air flow, and velocity into a single, rugged meter.

Use the Fluke 922 to:

- Ensure proper air flow balance
- Monitor pressure to extend HVAC component life
- Promote good indoor air quality
- Maintain a comfortable environment

Features include:

- Powerful meter provides differential and static pressure, air velocity and flow readings
- Rugged case and holster for real-world use
- Easy to use without sacrificing performance
- User-defined duct shape and size for maximum utility
- Convenient colored hoses helps users properly diagnose pressure readings
- Bright, backlit display for less than ideal environments
- Min/Max/Average/Hold functions for easy data analysis
- Auto power off saves battery life

Operating specifications

Feature	Range	Resolution	Accuracy
Air Pressure	± 4000 Pascals ± 16 in H_2O ± 400 mm H_2O ± 40 mbar ± 0.6 PSI	1 Pascal 0.001 in H_2O 0.1 mm H_2O 0.01 mbar 0.0001 PSI	± 1 % + 1 Pascal ± 1 % + 0.01 in H_2O ± 1 % + 0.1 mm H_2O ± 1 % + 0.01 mbar ± 1 % + 0.0001 PSI
Air Velocity	250 to 16,000 fpm 1 to 80 m/s	1 fpm 0.001 m/s	± 2.5 % of reading at 2000 fpm (10.00 m/s)
Air Flow (Volume)	0 to 99,999 cfm 0 to 99,999 m3/hr 0 to 99,999 l/s	1 cfm 1 m3/hr 1 l/s	Accuracy is a function of velocity and duct size
Temperature	0 °C to 50 °C 32 °F to 122 °F	± 1 % + 2 °C ± 1 % + 4 °F	0.1 °C 0.1 °F

Quick Tips

How HVAC airflow impacts operating costs

Dirty coils, fans, and filters will increase static pressure by reducing airflow, causing HVAC equipment to work harder to meet occupant loads and increasing energy costs. With HVAC energy costs often comprising over 50 % of the total energy bill, tighter monitoring and control of HVAC airflow can have a direct impact on the bottom line.

- In a study[1] on coil cleaning and energy savings in a New York City high rise, pressure monitoring and visual inspection led to restoration of the coils and components. The restoration resulted in a 14 % decrease in pressure drop across the coils, a 25 % increase in the coil's thermal efficiency, and energy savings of up to $40,000 in the first year.
- EPA studies[2] show that a 15 cfm airflow differential can impact annual HVAC energy costs by up to 8 % depending upon the HVAC system and variations in climate.

[1] Baker, Robert G.; Montgomery, Ross D. "Coil Cleaning and its Resultant Energy Savings and Maintenance Enhancements." Indoor Air Quality Conference Proceedings, 2006:22–27.

[2] "Energy Cost and IAQ Performance of Ventilation Systems and Controls, Project Report #4." United States Environmental Protection Agency, January 2000:10.

Ordering information

Fluke-922 Airflow Meter

Includes: Two rubber hoses, four AA batteries 1.5 V alkaline, users manual and soft carrying case

Fluke-922/Kit

Includes: Fluke 922 Airflow Meter, 12 inch Pitot tube, two rubber hoses, TPak magnetic strip, TPak strap, 9 inches, TPak latch tab, four AA batteries 1.5 V alkaline, users manual, hard carrying case

Optional accessories

PT12 12" Pitot Tube

Fluke-TPAK ToolPak™

Air Composition

CO Detector and Probe

Fluke CO-220 Carbon Monoxide Meter

- Standalone CO meter that does not require a digital multimeter
- Large backlit LCD displays CO levels from 0 to 999 ppm, with a resolution of 1 ppm and accuracy of ± 5 %
- Beeper triggers with increasing frequency as CO levels rise
- MAX hold function stores and displays the maximum CO level
- Automatic sensor zeroing and self-test upon startup

Fluke CO-210 Carbon Monoxide Probe

- Used as an accessory to a digital multimeter with dc millivolt inputs
- Displays CO level readings from 0 to 1000 ppm, with a resolution of 1 ppm and accuracy of ± 5 %
- Also used as a standalone device with an LED indicator and beeper that triggers with increasing frequency as CO levels rise

Fluke CO-205 Aspirator Kit

The CO-205 flue gas sampling accessory kit contains all the components necessary to provide a clean sample for the Fluke family of gas measuring devices.

The CO-205 accessory kit includes:

- Stainless steel sampling tube
- Industrial-grade hand operated aspirator to draw flue sample
- Easily replaceable particulate filter
- Specially designed nose cap for connection to the Fluke CO-210/220

What is carbon monoxide (CO)?

Carbon monoxide (CO) is a colorless, odorless, poisonous gas with potentially serious health consequences given adequate exposure.

CO levels	Exposure symptoms
70 to 100 ppm	Flu or food poisoning like: Mild headaches Sore eyes Runny nose Mild nausea Shortness of breath
150 to 300 ppm	Dizziness Headaches Drowsiness Vomiting
400 and higher ppm	Unconsciousness Brain damage Death

Treatment options

Get victim to fresh air immediately.

If you can't get victim out of the building open all windows and doors.

Take victim to a hospital emergency room for a carbon monoxide blood test.

How many people are unintentionally poisoned by CO?

Every year, over 200 people in the United States die from CO produced by fuel-burning appliances (furnaces, ranges, water heaters, room heaters). Others die from CO produced while burning charcoal inside a home, garage, vehicle or tent. Still others die from CO produced by cars left running in attached garages. Several thousand people go to hospital emergency rooms for treatment for CO poisoning.

What is the permissible exposure to CO?

The current Occupational Safety and Health Administration (OSHA) permissible exposure limit (PEL) for carbon monoxide is 50 ppm over an 8-hour time period.

Ordering information

Fluke-CO-220 Carbon Monoxide Meter

Includes: Soft carrying case, battery and instruction sheet

Fluke-CO-210 Carbon Monoxide Probe

Includes: Soft carrying case, battery and instruction sheet

Fluke-CO-205 Aspirator Kit

Includes: Instruction sheet

Temperature Humidity Meter

Fluke 971 Temperature Humidity Meter

The rugged new answer to humidity and temperature in your building.

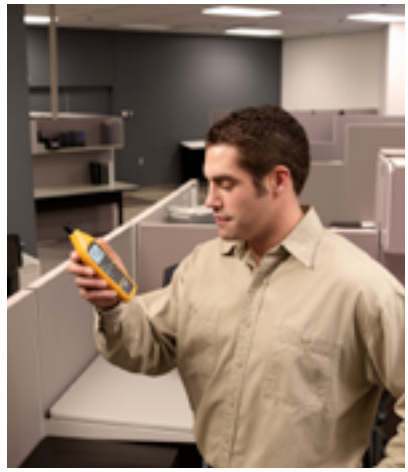
Quickly take accurate humidity and temperature readings. Temperature and humidity are two important factors in maintaining optimal comfort levels and good indoor air quality. The Fluke 971 is rugged, lightweight, and easy to hold.

Use it to:

- Monitor indoor comfort conditions and respond to "hot/cold" calls from occupants
- Matching HVAC system capacity to the load
- Promote good indoor air quality

Key features:

- Fast-settling humidity sensor
- Instant wet bulb and dewpoint temperature calculations
- Bright backlit display
- Rugged holster and protective twist-open sensor cover
- Convenient Min/Max feature and data storage capacity



Quick Tips

Duct temperatures

Use the Fluke 971 and an infrared thermometer to monitor duct temperatures at the register. Easily calculate dewpoint with the Fluke 971, then compare it to register temperatures to see if they fall below the dewpoint. Use an infrared thermometer in this application as a general indicator only. Many factors come into play when taking IR measurments, such as emissivity and spot-to-distance ratio. Lower temperatures can lead to condensation forming on duct-work. If uninsulated, moisture can fall onto ceiling materials and cause potential mold issues and water damage.

Did you know?

Studies indicate that productivity can increase anywhere from 0.5 % to 5 % given a comfortable work environment. Use the Fluke 971 to monitor and maintain comfortable conditions for your customers—and demonstrate the effectiveness of your repairs.

Summary specifications

Feature		
Temperature range	-20 °C to 60 °C (-4 °F to 140 °F)	
Temperature accuracy	0 °C to 45 °C	± 0.5 °C
	-20 °C to 0 °C and 45 °C to 60 °C	± 1.0 °C
	32 °F to 113 °F	± 1.0 °F
	-4 °F to 32 °F and 113 °F to 140 °F	± 2.0 °F
Resolution	0.1 °C / 0.1 °F	
Temperature update rate	500 ms	
Temperature sensor type	NTC	
Relative humidity range	5 % to 95 % R.H.	
Relative humidity accuracy	10 % to 90 % R.H. @ 23 °C (73.4 °F)	± 2.5 % R.H.
	<10 %, > 90 % R.H. @ 23 °C (73.4 °F)	± 5.0 % R.H.
Resolution	0.1 % R.H.	
Response time (humidity)	For 90 % of total range—60 sec. with 1 m/s air movement	
Humidity sensor	Electronic capacitance polymer film sensor	
Data storage	99 points	

Ordering information

Fluke-971 Temperature Humidity Meter

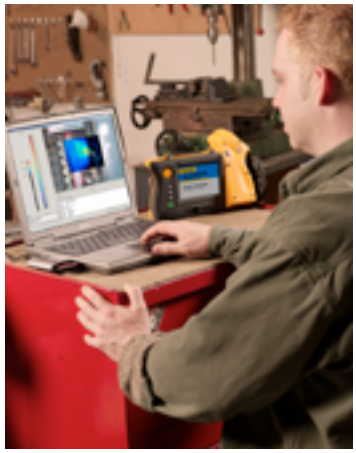
Includes: Users manual, and 4 AAA alkaline batteries

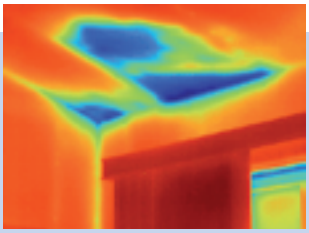
Thermal Imager

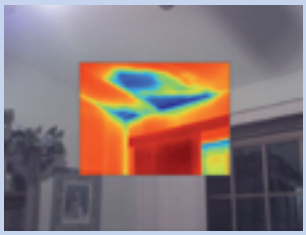
Fluke TiR Series Flexcam Thermal Imagers

The expert's choice for building diagnostics.

High resolution, industry leading sensitivity and large, five-inch color display make these imagers perfect for building diagnostics. IR Fusion technology integrates thermal and visual images. A 180° articulating lens plus one-finger SmartFocus deliver great images when access is poor. Built-in auto-capture, alarm, and analysis functions help you locate intermittent problems (TiR2 and TiR4 only). Powerful analysis and reporting software is included with the TiR cameras.







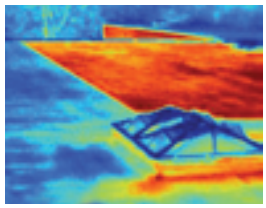
IR-Fusion™ Technology

Infrared and visible light images fused together on one display.

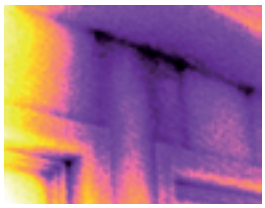
IR-Fusion™ Technology captures a visible light image in addition to the infrared image and takes the mystery out of IR image analysis. It helps to better identify and report suspect components and enable the repair to be done right the first time.

Use it for:

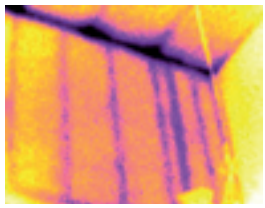
Moisture detection: Accurately detect moisture behind interior walls, in ceilings, and under carpets.



Roofing: Detect water-saturated insulation in flat-roof systems to locate damaged portions of roofing structure.



Mold remediation: Control mold by revealing undetected sources of moisture.



Energy audits: Perform residential and commercial energy audits by scanning for heat loss, moisture invasion and HVAC problems.

Ordering information

Fluke-TiR2-20 IR FLEX-CAM BD Thermal Imager

Fluke-TiR2/FT-20 IR FLEXCAM BD Thermal Imager with IR-Fusion

Fluke-TiR3-20 IR FLEX-CAM BD Thermal Imager

Fluke-TiR3/FT-20 IR FLEXCAM BD Thermal Imager with IR-Fusion

Fluke-TiR4-20 IR FLEX-CAM BD Thermal Imager with IR-Fusion

Includes: Heavy duty carrying case, 2 rechargeable battery packs, battery charger, ac adapter (for R2 and R4 models only), video cable, 512 MB compact flash card, compact flash card adaptor and USB cable, PCMCIA compact flash card reader, neck strap, SmartView™ reporting and analysis, software on CD and user manual on CD

Fluke IR InSight® Thermal Imagers
The perfect camera for quick, accurate building surveys.

Combine outstanding image quality and thermal sensitivity. InSight infrared imagers are optimized for low contrast thermal applications encountered in building applications and easily show problems other infrared cameras cannot. These easy-to-use cameras include SmartView™ software to prepare professional infrared survey reports.

Key features:

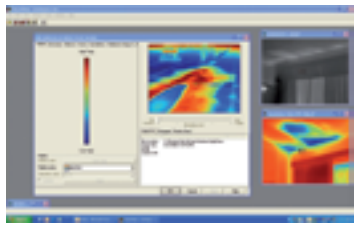
- 160 x 120 focal plane array
- High resolution, ultra high-quality images
- Industry-leading thermal sensitivity (≤ 0.07 °C NETD)
- Simple, robust one-button operation
- 3.5 inch, 30 bit color, high resolution high-contrast display
- SmartView™ professional report writing software

SmartView™ Software
For the XS and XST InSight® Thermal Imagers.

Fluke SmartView™ software is included with each Fluke InSight Thermal Imager. This powerful software provides all the tools you need to organize your infrared images.

- Easily generate customized, professional reports
- Images transferred as PGM format and saved as JPEG or BMP (Microsoft® Word compatible)
- View images in 10 color palette
- Parameter controls: Emissivity and background temperature

For detailed specifications, see www.fluke.com/buildingresources.



Navigate, analyze and enhance IR images

Ordering information

Fluke-INSXT-20
IR InSight, 20MM, XST

Fluke-INSXS-20
IR InSight, 20MM, XS

Includes: Heavy-duty carrying case, 2 rechargeable battery packs, battery charger, video cable, serial/USB download adapter kit/cable, neck strap, SmartView reporting and analysis software on CD and users manual on CD

Summary specifications for TiR and Insight thermal imagers

Feature	TiR4-FT	TiR4	TiR3-FT	TiR3	TiR2-FT	TiR2	Insight XST	Insight XS
High-resolution, low noise VOx detector for high-quality images	320 x 240				160 x 120			
Temperature range for building diagnostic applications	–20 °C to +100 °C						0 °C to +100 °C	
High thermal sensitivity for viewing even the smallest temperature differences	≤ 0.05 °C		≤ 0.07 °C					
180° articulating flexible lens to view images in every situation	•	•	•	•	•	•		
Choice of three interchangeable lenses to cover every application	•	•	•	•	•	•		
Large 5 in. high-contrast color LCD for a clear picture independent of lighting conditions	•	•	•	•	•	•		
Fully radiometric for detailed temperature analysis and tracking	•	•	•	•	•	•	center point	imager only
SmartFocus for best image quality and accurate temperature measurements	•	•	•	•	•	•		
Windows CE based menu structure for ease of use	•	•	•	•	•	•		
Personalized instrument set-up for multiple user profiles	•	•	•	•	•	•		
Compact Flash memory cards store more than 1000 IR images plus fully radiometric temperature data	•	•	•	•	•	•	300	300
SmartView reporting and analysis software included	•	•	•	•	•	•	•	•
AutoCapture for making intermittent problems visible	•	•			•	•		
On-board analysis functions	•	•			•	•		
User defined text annotations for simplified reporting	•	•			•	•		
Built-in visible light (digital) camera	•		•		•			
IR-Fusion blending thermal and visible light images to easily pinpoint suspect components	•		•		•			
IR/Visible Alarm function	•		•		•			
Laser pointer for easy targeting	•		•		•			
Flash and torch light for high quality images in dark environments	•		•		•			
Imaging performance: thermal								
Field of view (FOV)*	23° horizontal x 17° vertical							
Spatial resolution (IFOV)*	1.30 mrad				2.60 mrad			
Minimum focus distance*	0.15 m							
Thermal sensitivity (NETD)	≤ 0.05 °C at 30 °C		≤ 0.07 °C at 30 °C					
Detector data acquisition/image frequency	60 Hz				30 Hz			
Focus	SmartFocus; one finger continuous focus						ring focus	
IR digital zoom	2x, 4x, 8x		2x					
Detector type	Vanadium Oxide (VOx) Uncooled Microbolometer							
Detector size	320 x 240 Focal Plane Array				160 x 120			
Spectral band	8 µm to 14 µm							
Digital image enhancement	Automatic full-time enhanced							
Temperature measurement								
Calibrated temperature range	–20 °C to 100 °C (–4 °F to 212 °F)						0 °C to 100 °C	
Accuracy	± 2 °C or 2 % (whichever is greater)							
Measurement modes	TiR2/TiR4: Centerpoint, center box (area min/max, average), moveable spots/boxes, user defined field/text annotations, isotherms, automatic hot and cold point detection, visible color alarm above and below TiR3: Centerpoint, center box (area min/max, average)							
Emissivity correction	0.1 to 1.0 (0.01 increments)							

For more product information and detailed specifications, go to www.fluke.com

IR Thermometer

Fluke 561 HVACPro

Multipurpose thermometer for heating, ventilation, air conditioning and refrigeration inspections

Combine the temperature measurement functions professionals need most for inspecting heating, ventilation, air conditioning and refrigeration systems. The Fluke 561 HVACPro provides both non-contact, and contact temperature measurements replacing several other test tools. It is fast, efficient and easy to use, saving you valuable time, and effort.

Use it to:

- Measure hot, moving, electrically energized and hard-to-reach objects instantly
- Check motors, insulation, breakers, radiant heating, pipes, corroded connections and wires plus scan ducts in the ceiling from the floor without a ladder
- Handy Velcro® pipe probe included for superheat and sub-cooling contact measurements
- Or, plug in your own industry-standard type-K thermocouple probes and get the most out of your tool investments

Key features:

- Compatible with all standard mini-connector type-K thermocouples
- Velcro pipe probe for superheat, sub-cooling or other contact and ambient measurements
- Single-point laser sighting, 12:1 distance-to-spot ratio
- Temperature range optimized for HVAC/R applications
- Easy emissivity adjustment for measuring pipes and ducts more accurately
- Lightweight, only 340 grams (12 ounces) and portable
- Easy to use
- Efficient—no need to shut down equipment when making IR measurements
- MIN, MAX and DIF temperature readings help you quickly identify problems
- Scan large areas or small objects quickly and efficiently
- HVAC/R measurement guide included to maximize your productivity

Indoor air quality: Can your schools pass the test?

Increases in temperature are often the first sign of trouble for mechanical equipment, electrical circuits and building systems such as heating, ventilation and air conditioning (HVAC). Read about how to take basic, quick temperature checks using infrared thermometers at www.fluke.com/iaq

Ordering information

Fluke-561 HVACPro

Includes: Type-K thermocouple Velcro pipe probe, Durable hard case, 2 AA batteries, user's manual with step-by-step application instructions (available in English, Spanish, French, Italian, German, Portuguese, and Simplified Chinese) and two-year warranty

Mini IR Thermometer

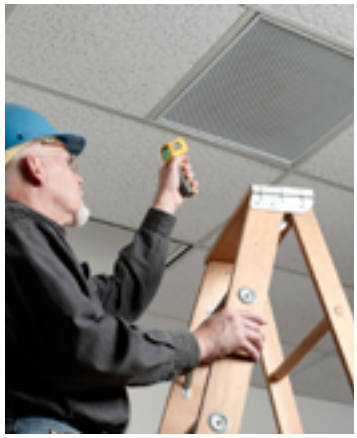
Fluke 62 Mini Infrared Thermometer

Measuring temperature in hard-to-reach, hot, rotating or dangerous situations.

The Fluke 62 Mini Non-contact Thermometer is the perfect introduction to infrared (IR) thermometers. With the best accuracy in its class, the Fluke 62 Mini offers quick and reliable surface temperature readings. This compact and portable tool enables professionals to diagnose heating and ventilation problems and monitor the temperature of electrical motors and electrical panels without contact. Rugged enough for industrial environments with its protective rubber "boot", the 62 Mini also comes with a handy nylon holster, keeping quick temperature checks at your fingertips.

Key features:

- Single point offset laser sighting, 10:1 distance-to-spot ratio
- Best accuracy in its class: +1 % of reading
- Holds temperature readings for seven seconds
- Dual displays shows current and MAX measurements simultaneously
- Backlit display for poorly lit areas
- Comfortable ergonomic handle with protective rubber boot for added durability
- Fitted carrying case
- Robust, award winning design
- Wide temperature range from –30 °C to 500 °C (–20 °F to 932 °F)



The Fluke 62 Mini Infrared Thermometer

Inspections: Ambient air, diffuser, window, and wall-surface temperature; blower component temperatures; sub-cooling; electrical inspection. Read a detailed application note on www.fluke.com/iaq

Ordering information

Fluke-62 Mini Infrared Thermometer

Includes: Storage pouch and instruction sheet

Fluke test tools to help you get the job done

Fluke 975 AirMeter

See page 6 for details

Fluke 983 Particle Counter

See page 4 for details

Fluke 971 Temperature Humidity Meter

See page 10 for details

Fluke 922 Airflow Meter

See page 9 for details

Fluke 116 Digital HVAC Multimeter

See page 22 for details

For more product information and detailed specifications, go to www.fluke.com

Fluke 561 HVACPro

See page 14 for details

Fluke 902 True-rms HVAC Clamp Meter

See page 20 for details

Fluke IR InSight XS/XST Thermal Imagers

See page 12 for details

Fluke TiR Series IR Flexcam Thermal Imagers

See page 11 for details

Fluke CO-220 Carbon Monoxide Meter

See page 8 for details

Legend

- Air Comfort
- Filtration
- Ventilation
- Electrical
- Motors, Pumps, Drives
- Furnace
- Buiding Structure

TC Thermometer

Fluke 54-II

Fluke 80PK-8

Fluke 54 Thermometer
Laboratory accuracy. Wherever you go.

The Fluke 54 Series II contact thermometer offers fast response and laboratory accuracy (0.05 % + 0.3 °C) in a rugged, handheld test tool.

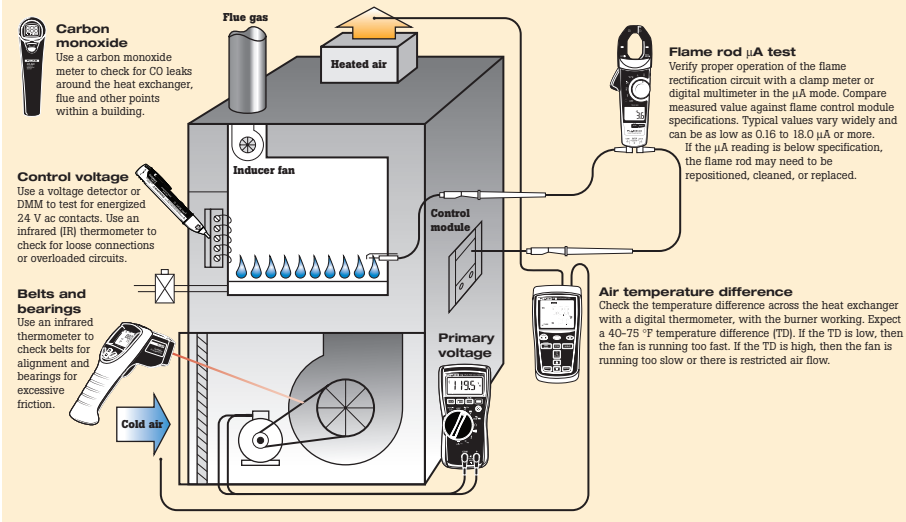
Key features:

- Relative time clock on MIN, MAX, and AVG provides a time reference for major events
- Electronic offset function allows compensation of thermocouple errors to maximize overall accuracy
- Readout in °C, °F, or Kelvin (K)
- Splash and dust resistant case protected by impact absorbing holster
- User-friendly front panel is easy to set up and operate
- Sleep mode increases battery life; typical 1000-hour battery life
- Battery door allows easy battery replacement without breaking the calibration seal
- Large backlit dual display shows any combination of T1, T2, T1-T2, plus MIN, MAX, or AVG
- Recall function allows logged data to be easily reviewed on the meter display
- IR communication port allows data to be exported to optional FlukeView® Forms Temperature PC software for further analysis and graphing
- Data Logging up to 500 points of data with user adjustable recording interval

80PK-8 Pipe Clamp Temperature Probe

- Type-K thermocouple for fast temperature and superheat measurements of pipe surfaces
- Durable ribbon sensor
- Measurement range: -29 °C to 149 °C (-20 °F to 300 °F) for pipe diameters from 6.4 mm to 34.9 mm (.25 in to 1.375 in)
- One-year warranty
- Accessory for use with DMM with dc millivolt input and 80AK DMM adapter

Gas heat


Carbon monoxide
Use a carbon monoxide meter to check for CO leaks around the heat exchanger, flue and other points within a building.
Flue gas
Heated air
Inducer fan
Control voltage
Use a voltage detector or DMM to test for energized 24 V ac contacts. Use an infrared (IR) thermometer to check for loose connections or overloaded circuits.
Control module
Belts and bearings
Use an infrared thermometer to check belts for alignment and bearings for excessive friction.
Cold air
Primary voltage
Flame rod µA test
Verify proper operation of the flame rectification circuit with a clamp meter or digital multimeter in the µA mode. Compare measured value against flame control module specifications. Typical values vary widely and can be as low as 0.16 to 18.0 µA or more. If the µA reading is below specification, the flame rod may need to be repositioned, cleaned, or replaced.
Air temperature difference
Check the temperature difference across the heat exchanger with a digital thermometer, with the burner working. Expect a 40-75 °F temperature difference (TD). If the TD is low, then the fan is running too fast. If the TD is high, then the fan is running too slow or there is restricted air flow.

Ordering information

Fluke-54 II Dual Input Digital Thermometer

Includes: Impact absorbing holster and two 80PK-1 beaded probe thermocouples

Fluke-80PK-8 Pipe Clamp Temperature Probe

HVAC Pressure Module

Fluke PV350 Pressure Vacuum Module

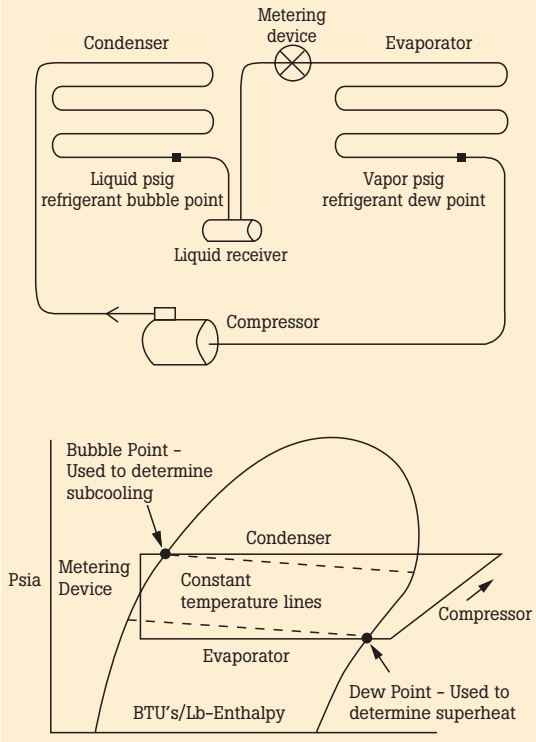
Key features:

- Compatible with all Fluke and most popular DMMs
- Digital pressure and vacuum measurements in a single module
- Transducer sealed in 316 stainless steel compatible with a variety of liquids and gases
- Measures vacuum to 76 cm Hg
- Displays results in English (psig or Hg) or metric (kPa or cm Hg) units
- Measures pressure to 3447 kPa (500 psig)

For use with:

Fluke 116

Refrigeration cycle



Pressure-Enthalpy (PH) diagram for refrigerant blends

Superheat temperature measurement points.

Quick Tips

Measuring superheat and subcooling

To measure superheat:

1) Measure suction pressure with a pressure module and your digital multimeter (DMM). Convert pressure to temperature using your PT chart.
2) Measure the pipe temperature at the outlet of the evaporator with a pipe clamp and your temperature meter.
3) Subtract the difference in temperatures to obtain superheat.

To measure subcooling:

1) Measure liquid line pressure (or discharge pressure if there is no liquid line access valve) with a pressure module and your DMM. Convert the pressure to temperature using your PT chart.
2) Measure the pipe temperature at the outlet of the condenser with a pipe clamp and your temperature meter.
3) Subtract the difference in temperatures to obtain subcooling.

Ordering information

Fluke-PV350 Pressure Vacuum Module

Voltage Detectors

Fluke 1AC-II/1LAC-II VoltAlert™ *Easy-To-Use Voltage Detector.*

The next generation VoltAlert™ ac non-contact voltage testers from Fluke are easy to use—just touch the tip to a terminal strip, outlet, or supply cord. When the tip glows red and the unit beeps, you know there is voltage present. Electricians, maintenance, service, safety personnel and homeowners can quickly test for energized circuits in the workplace or at home.

Two models to choose from:

- **1AC-II**: detects voltage from 90 V ac to 1000 V ac
- **1LAC-II:** detects voltage from 20 V ac to 90 V ac

Key features:

- Fits in a shirt pocket for convenience
- All outer surfaces are non-conductive for safety
- Detects voltage without metallic contact
- Quickly locates the hot, neutral and ground terminals in any receptacle
- Certified up to CAT IV 1000 V

Verifying lockout/tagout electrically safe status

For non-electricians working in electrical environments

Lockout/Tagout procedures specify the steps electricians must follow to remove power from an electrical circuit or panel, and to lock out and tag the panel or circuit, so that no one can re-energize it while work is in progress. Read a detailed application note on www.fluke.com/iaq

Ordering information

Fluke-1AC-II
Voltage Detector
Fluke-1LAC-II
Voltage Detector

HVAC Electrical Tools
True-rms Clamp Meter

New Fluke 902 True-rms HVAC Clamp Meter

Clamp designed just for HVAC professionals.

Heating, ventilation, air conditioning (HVAC) technicians require a service tool that can consistently keep up with their demands. The Fluke 902 expands the existing line of quality Fluke clamp meters by delivering the features necessary to diagnose and repair HVAC systems. Combined with true-rms technology and a CAT III 600 V rating, the Fluke 902 helps technicians do their jobs safely and accurately.

Use it to:

- Capture flue gas temperatures
- Conduct flame rod testing
- Measure start and run motor capacitors

Key features:

- Capacitance
- DC current to 200 uA
- Contact temperature (Type-K thermocouple)
- True-rms
- Min/Max
- Hold

Why true-rms matters for HVAC technicians

Non-linear loads need a true-rms test tool for accurate readings

For today's HVAC technician, troubleshooting electrical problems is becoming more difficult without the use of true-rms test tools. This is due in part to the proliferation of new solid state adjustable speed motor drives and heating controls containing power semiconductors or rectifiers. These loads are referred to as "non-linear." Non-linear loads draw current in short pulses rather than the smooth sine wave drawn by a linear load such as an induction motor. The current wave shape can have a drastic effect on a test tool reading. Read a detailed application note on www.fluke.com/iaq

Summary specifications

Feature	Range	Accuracy
Voltage dc	0 to 600.0 V	1 % ± 5 counts
Voltage ac (true-rms)	0 to 600.0 V	1 % ± 5 counts (50/60 Hz)
Current ac (true-rms)	0 to 600.0 A	2.0 % ± 5 counts (50/60 Hz)
Current dc	0 to 200.0 µA	1.0 % ± 5 counts
Resistance	0 to 9999 Ω	1.5 % ± 5 counts
Continuity	<= 30 Ω	
Temperature* (Type-K thermocouple)	-10 °C to 400 °C (-14 °F to 752 °F) -40 °C to -10 °C (-40 °F to -14 °F)	± 1.0 % + 0.8 °C (± 1.0 % + 1.5 °F) typical ± 5.0 % + 1.5 °C (± 5.0 % + 3.3 °F) typical
Capacitance	1 µF to 1000 µF	1.9 % ± 2 counts
Warranty	Three-years	

Ordering information

Fluke-902 HVAC Clamp Meter

Includes: AA alkaline batteries (2), users manual (w/safety information), soft carrying case, TL75 Test Leads (1 pair), and 80BK Integrated DMM Temperature Probe (1)

For more product information and detailed specifications, go to www.fluke.com

Temperature DMM

New

Fluke 116 HVAC Multimeter with Thermometer

Measures temperature and microamperes

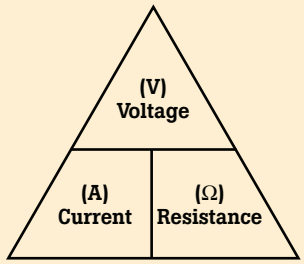
The Fluke 116 was specifically designed for the HVAC professional. It has everything needed in an HVAC meter including temperature and microamp measurements to quickly trouble-shoot problems with HVAC equipment and flame sensors. Use the Fluke 116 to test motor start and run capacitors up to 10,000 micro-farads. Rely on the Fluke 116 to make your everyday measurements—up to 600 volts ac or dc, 40 MΩ, diode test and exceptionally fast continuity.

Key features:

- Built in thermometer
- Microamps to test flame sensors
- LoZ: helps prevent false readings due to ghost voltage
- Resistance, continuity, frequency and capacitance
- Min/Max/Average
- Compact ergonomic design
- Compatible with optional magnetic hanger (ToolPak™)
- CAT III 600 V safety rated
- IP52 rating for dust and water protection

Quick Tips

Understanding Ohm's Law



V = A x Ω

Where: V = Volts
A = Current in Amps
Ω = Resistance in Ohms

Ohm's Law explains the relationship between voltage, current and resistance. Put your finger over the value you want to find. Multiply the remaining values if side-by-side; divide if one is over the other. But it really is much easier just to use your DMM.

Function	Range and resolution	Best accuracy ± ([% of reading] + [counts])
mV dc true rms	600.0 mV	2.0 % + 3
V dc	6.000 V, 60.00 V, 600.0 V	2.0 % + 3
mV ac true rms	600.0 mV	1.0 % + 3
V ac true rms	6.000 V, 60.00 V, 600.0 V	1.0 % + 3
Resistance	600.0 Ω, 6.000 kΩ, 60.00 kΩ, 600.0 kΩ, 6.000 MΩ, 40.00 MΩ	0.9 % + 1
Capacitance	1000 nF, 10.00 µF, 100.0 µF, 9999 µF 100 µF to 1000 µF, >1000 µF	1.9 % + 2
Lo-Z Capacitance	1 nF to 500 µF	10 % + 2 typical
Temperature (Type K)	–40 °C to 400 °C (–40 °F to 752 °F)	1 % + 10 (1 % + 18)
AC µA true rms (45 Hz to 500 Hz)	600.0 µA	1.5 % + 3 (2.5 % + 3 > 500 Hz)
DC µA	600.0 µA	1.0 % + 2
Frequency	99.99 Hz, 999.9 Hz, 9.999 Hz, 50.00 kHz	0.1 % + 2

Ordering information

Fluke-116 HVAC Multi-meter with Temperature and Microamps

Includes: TL75 Test Leads, 80BK Integrated Temperature Probe, holster, User's manual and 9 V battery (installed).

Insulation Multimeters

Fluke 1587 Insulation Multimeters
Two powerful tools in one.

The Fluke 1577 and 1587 Insulation Multimeters combine a digital insulation tester with a full-featured, true-rms digital multimeter in a single compact, handheld unit, which provides maximum versatility for both troubleshooting and preventative maintenance. Like other tools you have come to expect from Fluke, the 1577 and 1587 are rugged, reliable, and easy to use. Whether you work on motors, generators, cables, or switch-gear, the Fluke 1577 and 1587 Insulation Multimeters are ideally suited to help you with your tasks.

Key features:

- Insulation test (1587: 0.01 MΩ to 2 GΩ) (1577: 0.1 MΩ to 600 MΩ)
- Insulation test voltages (1587: 50 V, 100 V, 250 V, 500 V, 1000 V), (1577: 500 V, 1000 V) for many applications
- Live circuit detection prevents insulation test if voltage > 30 V is detected for added user protection
- Auto-discharge of capacitive voltage for added user protection
- Filter for motor drive measurements (1587 only)
- AC/DC voltage, dc millivolts, ac/dc milliamps, resistance (Ω) and continuity
- Capacitance, diode test, temperature, Min/Max, frequency (Hz) (1587 only)
- Auto power off to save battery power
- Large display with backlight and large digits
- Accepts optional Fluke TPAK™ magnetic hanging system to free your hands for other work
- Rugged, utility hard case allows you to bring everything you need for the job
- Three-year warranty

Insulation resistance testing

Insulation resistance testers can be used to determine the integrity of windings or cables in motors, transformers, switchgear, and electrical installations. The most important reason for testing insulation is to insure public and personal safety. The second most important reason for insulation testing is to protect and prolong the life of electrical systems and motors. Read more about the importance of insulation testing and the tools and techniques to use in the application note on www.fluke.com/electrical

Ordering information

Fluke-1577 Insulation Multimeter

Fluke-1587 Insulation Multimeter

Includes: Remote probe, test leads, alligator clips, type-K thermocouple (1587 only), hard case, and user documentation.

Accessories

Test Leads and Probes

TL81A Deluxe Electronic Test Lead Set

- 22 piece set with quadfold pouch
- Includes mini alligator clips, hooks and pincers for virtually every electronic need
- Slide-on lc probe tip adapter and test lead couplers
- Both modular test leads and lead-probe combinations
- CAT II 300 V
- Use with 179 and 87V DMM

TL910 Electronic Test Probes with replacement tips

- Small profile provides accessibility
- Comes with five sets of replaceable tips
- Replacement tips: TP912
- CAT III 1000 V, 3 A

Push-On Clips

AC72 Alligator Clips

- Slide-on style for test probes
- Jaws open to 8 mm
- For use with TL71 and TL75 test lead and probe sets
- CAT III 1000 V, 10 A, CAT IV 600 V, 10 A

Test Lead and Probe in One

TL71 Premium DMM Test Lead Set

- Flexible silicone insulated leads are heat and cold resistant
- Distinctive comfort grip probes
- Recommended for µV measurements
- CAT III 1000 V, 10 A, CAT IV 600 V, 10 A
- Use with 16, 179, 87V DMM and 336 Clamp Meter

TL76 2 mm/4 mm Test Lead Set

- 2 mm threaded probes with removable 4 mm banana-style spring contacts
- Flexible 1.5 m silicone leads
- CAT III 1000 V, CAT IV 600 V, 10 A
- Use with 16, 179, 87V DMM and 336 Clamp Meter

Sets and Kits

TL220 Industrial Test Lead Set

- Starter kit for industrial applications
- TP220 has round, stainless steel tip
- Includes one pair: AC220, TP220 and TL222
- CAT III 1000 V, CAT IV 600 V, 10 A
- Use with 16, 179, 87V DMM and 336 Clamp Meter

High-Voltage Probes

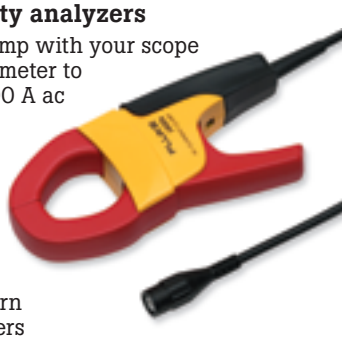
80K-40 High Voltage Probes

- Allows a digital multimeter to measure up to 40,000 volts peak
- 1000:1 division ratio output when connected to 10 MΩ multimeter
- Ground clip included
- Intended for low energy applications that are referenced to ground

Accessories

AC Current Clamp

i400s AC current clamp for oscilloscopes and power quality analyzers



- Pair a current clamp with your scope or power quality meter to measure up to 400 A ac
- Only current clamp available with a CAT IV 600 V/CAT II 1000 V safety rating makes them ideal companions for modern CAT IV rated meters
- Specially designed to offer maximum utility in a compact shape
- Take accurate current readings without breaking the circuit
- Soft non-slippery overmold handle
- Can be used with DMMs with optional PM9081/001 BNC/Banana adapter

Modular Clips (for use with test leads)

AC220 SureGrip™ Alligator Clips

- Insulated, nickel plated jaws grip objects up to 3/8 in.
- Blunt tip grabs round screw heads
- CAT III 1000 V, CAT IV 600 V, 10 A

AC285 SureGrip™ Alligator Clips

- Multi-purpose tooth pattern grips anything from fine gauge wire to a 3/4 in. nut
- Nickel-plated steel jaws
- CAT III 1000 V, CAT IV 600 V, 10 A

Adapters

PM9081

- Dual Banana Plug 4 mm male to female BNC Adapter
- The set consists of two adapters

Temperature Accessories

80AK DMM Adapter

- Adapts type-K thermocouple mini-connector to dual banana plug inputs
- Compatible with all Fluke DMMs with temperature measurement functions

80BK Integrated DMM Temperature Probe

- Compatible with all Fluke DMMs with temperature measurement functions
- Type-K thermocouple with standard banana jack
- Measurement range: -40 °C to 260 °C (-40 °F to 500 °F)

80PK-11 Type-K Velcro™ Temperature Probe

- Designed for hands free measurement of HVAC temperature measuring applications
- Use multiple and leave in place for route-based routine maintenance
- Use with any temperature measuring instrument designed to accept type-K thermocouples

Holster

C10 Meter Holster

- Snap on yellow holster absorbs shocks and protects meter from rough handling
- Fits Fluke 10 Series DMMs

Soft Cases

C12A Meter Case

- Zippered carrying case with inside pockets and belt loop
- For 110, 111, 112, 12 and 16 DMMs

C90 Meter Case

- Zippered carrying case with inside pocket and belt loop
- Holds mid-sized DMMs and process meters

C25 Meter Case

- Zippered carrying case with padding and inside pocket
- Holds large DMMs and process meters

C125 Meter Case

- Zippered carrying case with detachable external pouch

A detailed list of heating, air conditioning, and HVAC terms

Glossary

Absolute humidity: The mass of water vapor per unit volume of air.

Absolute pressure: Pressure above a perfect vacuum. Absolute pressure is the sum of gage pressure plus atmospheric pressure.

Air exchange rate: Used in two ways: 1. the number of times the outdoor air replaces the volume of air in a building per unit time, typically expressed as air changes per hour; 2. the number of times that the ventilation system replaces the air within a room or area within the building.

Air flow: The movement of air from one location to another, commonly measured in cubic feet per minute (CFM).

Air velocity: The distance traveled per unit of time, commonly measured in feet per minute (FPM).

Air handling unit (AHU): Refers to equipment that includes a blower or fan, heating and/or cooling coils, and related equipment such as controls, condensate drain pans, and air filters. Does not include ductwork, registers or grilles, or boilers and chillers.

Allergen: A substance capable of causing an allergic reaction because of an individual's sensitivity to that substance.

Ambient air: Unconditioned atmospheric air.

Atmospheric pressure: Standard atmosphere is the pressure equivalent of 14.696 psi or 29.921 in. Hg at sea level. Measured with a barometer, it is an indication of the "weight" of the air.

Boiler: A pressure vessel that safely and efficiently transfers heat to water.

BTU: British Thermal Unit. A measure of the heat given off when fuel is combusted. One BTU is equal to the heat necessary to raise one pound of water 1 °F.

Building envelope: Elements of the building, including all external building materials, windows, and walls, that enclose the internal space.

Building-related illness (BRI): Diagnosable illness whose symptoms can be identified and whose cause can be directly attributed to airborne building pollutants (e.g., Legionnaire's disease, hypersensitivity pneumonitis).

Capacity: The output of a heating or cooling system for a given amount of space. For heating, this is usually expressed in BTU's. For cooling, it is usually expressed in tons.

Carbon dioxide: (CO_2), a clear, odorless gas found in nature (around 380 ppm), most commonly associated with respired air. The gas is largely considered non-poisonous, but can result in suffocation in sufficient quantities.

Carbon monoxide: A clear, odorless gas made when carbon or other fuel is burned during the combustion process. The gas is poisonous, with exposure resulting in symptoms such as headaches, nausea, or even death.

Ceiling plenum: Space below the flooring and above the suspended ceiling that accommodates the mechanical and electrical equipment and that is used as part of the air distribution system. The space is kept under negative pressure.

Central air handling unit (Central AHU): This is the same as an Air Handling Unit, but serves more than one area.

Chiller: Hydronic air conditioning system which cools water, which cools air.

Compressor: Mechanical device that compresses refrigerant or other fluid.

Condensate: Liquid formed when a vapor has cooled below its dewpoint.

Condenser: Heat exchanger that removes heat from high-pressure refrigerant vapor.

Conditioned air: Air that has been heated, cooled, humidified, or dehumidified to maintain an interior space within the "comfort zone." (Sometimes referred to as "tempered" air.)

Constant air volume systems: Air handling system that provides a constant air flow while varying the temperature to meet heating, and cooling needs.

Cooling coil: Typically copper or aluminum tubing arranged to transfer the heat from air to a refrigerant.

Dampers: Controls that vary airflow through an air outlet, inlet, or duct. A damper position may be immovable, manually adjustable or part of an automated control system.

Demand controlled ventilation: Any system used to vary air intake rates based upon the loads placed upon the system, given a predefined space.

Dewpoint temperature (dp): Temperature below which moisture in the air begins to condense.

Differential pressure: The difference in static pressure measured between two locations.

Diffusers: Components of the ventilation system that distribute and diffuse air to promote air circulation in the occupied space. Diffusers supply air, and grilles return air.

Draft: Air movement resulting in a local cooling effect on the body. The intensity of the draft is dependent upon a variety of factors which include air velocity, temperature, occupant activity, and occupant clothing.

Drain trap: A dip in the drain pipe of sinks, toilets, floor drains, etc., which is designed to stay filled with water, thereby preventing sewer gases from escaping into the room.

Dry bulb temperature: Measurement of sensible heat.

Economizer: A mechanical device that makes system adjustments in response to changing conditions in order to maximize energy efficiency. An economizer typically contains a thermostat control that opens the dampers when outside air temperatures are lower than indoors, providing "free cooling". Many economizers will incorporate humidity sensors to ensure outside air is both cool and dry enough to allow indoors, unconditioned.

Emissivity: The efficiency with which the surface material of a certain object emits energy. Emissivity is an important consideration in using infrared to measure temperatures on reflective surfaces.

Enthalpy: (h) Total heat contained in a substance, which is the sum of sensible heat and latent heat.

Evaporator coil: Cools and dehumidifies the air by converting liquid refrigerant into a gas, which absorbs the heat from the air.

Exfiltration: The controlled or uncontrolled movement of air out of a building, through cracks, and other openings.

Exhaust air: Air that is removed from a space, and not recirculated into the system.

Exhaust ventilation: Mechanical removal of air from a portion of a building (e.g., piece of equipment, room, or general area).

Fan coil: A component of a heat pump system, used to provide additional heat when the heat pump does not provide adequate heating.

Filter efficiency: The ratio of particles trapped by filter media compared to the total number of particles found in the air upstream of the filter.

Filter, HEPA: High-efficiency particulate arrestance (HEPA) filter that is at least 99.97 percent efficient in removing particulate matter with a diameter of 0.3 micrometers or greater.

Flame rod: Combustion safety control that conducts electricity through a flame for flame detection.

Forced-air heating system: Uses air to carry heat.

Fungi: Any of a group of parasitic lower plants that lack chlorophyll, including molds and mildews.

Green buildings: The building industry is increasingly focused on making its buildings "greener," which includes using healthier, less polluting and more resource-efficient practices. Indoor environmental quality (IEQ) refers to the quality of the air and environment inside buildings, based on pollutant concentrations and conditions that can affect the health, comfort and performance of occupants—including temperature, relative humidity, light, sound, and other factors. Good IEQ is an essential component of any building, especially a green building.

Heat exchanger: Material that transfers heat from one substance to another without allowing the substances to mix.

Heat pump: Mechanical compression refrigeration system that contains devices and controls that reverse the flow of refrigerant. Reversing the flow of refrigerant switches the relative position of the evaporator and condenser.

Heat: Form of energy identified by temperature difference or a change of state.

HEPA: High efficiency particulate arrestance (filters).

Hydronic heating system: Heating system that uses water, steam, or other fluid to carry heat from the point of generation to the point of use.

Indoor air pollutant: Particles and dust, fibers, mists, bioaerosols, and gases or vapors.

Infiltration air: Air that flows into a building when outer doors are open or when air leaks in through cracks around doors, windows, or other openings.

Laminar air flow: Streamlined airflow in which the entire mass of air within a designated space moves with uniform velocity in one direction along parallel flow lines with minimal mixing.

Latent heat: Heat identified by a change of state and no temperature change.

Load: The amount of heat imposed on a refrigerant system, or the required rate of heat removal in order to maintain a constant temperature in a building. Typically expressed as a unit of heat per unit of time (i.e. BTU/hr).

Makeup air: Air that is used to replace air that is lost to exhaust.

Mixed air: A combination of return air and outside air, prior to conditioning and being supplied to the building.

Negative pressure: Condition that exists when less air is supplied to a space than is exhausted from the space, so the air pressure within that space is less than that in surrounding areas. Under this condition, if an opening exists, air will flow from surrounding areas into the negatively pressurized space.

Organic compounds: Chemicals that contain carbon. Volatile organic compounds vaporize at room temperature and pressure. They are found in many indoor sources, including common household products, and building materials.

Outdoor air supply: Air brought into a building from the outdoors (often through the ventilation system) that has not been previously circulated through the system. Also known as "Make-up Air."

A detailed list of heating, air conditioning, and HVAC terms

Glossary

Particulate: Small liquid or solid particles found in air or emissions. Airborne particles can be generated as a result of a mechanical break up of solid matter ("coarse particles") or through chemical reactions or condensing gases ("fine particles"). Typically measured in micrometers, particle sizes vary greatly in size and therefore behavior. Particles greater than 1 micron tend to settle out of the atmosphere but remain suspended given sufficient air currents. Particles ranging from 0.1 to 1 micron tend to stay airborne with the slightest air movement, and smaller than 0.1 will typically remain suspended indefinitely.

PELs: Permissible Exposure Limits (standards set by the Occupational, Safety and Health Administration, OSHA).

Pickup: Additional heat needed to warm the water in a hydronic heating system after a period of off-time such as overnight.

Plenum: Air compartment connected to a duct or ducts.

Pollutant pathways: Avenues for distribution of pollutants in a building. HVAC systems are the primary pathways in most buildings; however all building components interact to affect how air movement distributes pollutants.

Positive pressure: Condition that exists when more air is supplied to a space than is exhausted, so the air pressure within that space is greater than that in surrounding areas. Under this condition, if an opening exists, air will flow from the positively pressurized space into surrounding areas.

Pressure drop: Decrease in water pressure caused by friction between water and the inside surface of a pipe as the water moves through the pipe.

Static pressure: In flowing air, the total pressure minus velocity pressure. The portion of the pressure that pushes equally in all directions.

Total pressure: In flowing air, the sum of the static pressure and the velocity pressure.

Velocity pressure: In flowing air, the pressure due to the velocity, and density of the air.

Radiant heat transfer: Radiant heat transfer occurs when there is a large difference between the temperatures of two surfaces that are exposed to each other, but are not touching.

Register: Device that covers the opening of the supply ductwork.

Reheat: Heat supplied at the point of use while a ventilated air supply comes from a central location.

Relative humidity (rh): Amount of moisture in the air compared to the amount of moisture the air would hold if it were saturated.

RELs: Recommended Exposure Limits (recommendations made by the National Institute for Occupational Safety and Health (NIOSH)).

Respirable particles: Airborne particles that are of a size that can penetrate into the lower respiratory tract. Such particles are often labeled "PM_{10}" particles, which include particulate matter with a diameter of 10 micrometers or less.

Return air: The air that is removed from a space and recirculated or exhausted to the outside.

RMS: "root mean square." It comes from a mathematical formula that calculates the "effective" value (or heating value) of any ac wave shape. "True-rms" calculates the heating value based upon the rms formula, providing an accurate value regardless of the wave shape.

Saturated air: Air which cannot hold more moisture, where the addition of moisture will result in condensation.

SEER: The Seasonal Energy Efficiency Ratio is a measure of the cooling efficiency of an air conditioner or heat pump. The ratio is defined as the total output provided by the unit over a typical usage period divided by the total energy input over the same period of time. The higher the SEER number, the more efficient the system is at converting electricity into cooling power.

Sensible heat: Heat that does not involve a change of state measured with a thermometer or sensed by a person.

Setpoint temperature: 1. In a forced-air heating system, the temperature at which the switch in a thermostat opens and closes. 2. In a hydronic heating system, the temperature at which the boiler water is maintained.

Sick building syndrome (SBS): Term that refers to a set of symptoms that affect some number of building occupants during the time they spend in the building and diminish or go away during periods when they leave the building. Cannot be traced to specific pollutants or sources within the building. (Contrast with "Building related illness").

Sources: Sources of indoor air pollutants. Indoor air pollutants can originate within the building or be drawn in from outdoors. Common sources include people, room furnishings such as carpeting, photocopiers, art supplies, etc.

Specific heat: Ability of a material to hold heat. Expressed as the ratio of the quantity of heat required to raise the temperature of a substance 1 °F to that required to raise the temperature of an equal mass of water 1 °F

Stack effect: The overall upward movement of air inside a building that results from heated air rising and escaping through openings in the building super structure, thus causing an indoor pressure level lower than that in the soil gas beneath or surrounding the building foundation.

Static pressure: Pressure exerted in all directions by a fluid or gas at rest. For fluids in motion, measured perpendicular to the direction of flow.

Steam trap: Steam boiler accessory that removes air and condensate from steam lines, and heating units.

Subcooling: Process of cooling of a substance such as a refrigerant to a temperature that is lower than the saturated temperature of the substance at a particular pressure.

Superheat: Sensible heat that is added to a substance after the substance has turned to vapor.

Supply air: A conditioned mixture of return air, and outside air delivered to a space.

Time-weighted average concentration (TWA): Refers to concentrations of airborne materials which have been weighted for a certain time duration, usually eight hours.

(TLV) threshold limit value: A time-weighted average concentration under which most people can work consistently for eight hours a day, day after day, without suffering harmful effects. The American Conference of Governmental Industrial Hygienists publishes a table of these values and accompanying precautions annually.

Ton: A unit of measure for cooling capacity. One ton=12,000 BTUs per hour.

Unit ventilator: A fan-coil unit package device for applications in which the use of outdoor- and return-air mixing is intended to satisfy tempering requirements, and ventilation needs.

Unitary system: Air conditioning system that has all components enclosed in one cabinet.

Variable air volume system (VAV): Air distribution system in which the air flow rate in the building spaces is varied by mixing dampers, but the temperature of the supply air remains constant.

Ventilation rate: The rate at which indoor air enters and leaves a building. Expressed in one of two ways: the number of changes of outdoor air per unit of time (air changes per hour, or "ach") or the rate at which a volume of outdoor air enters per unit of time (cubic feet per minute, or "cfm").

Volatile organic compounds (VOCs): Compounds that vaporize (become a gas) at room temperature. Common sources which may emit VOCs into indoor air include housekeeping and maintenance products, and building and furnishing materials. In sufficient quantities, VOCs can cause eye, nose, and throat irritations, headaches, dizziness, visual disorders, memory impairment; some are known to cause cancer in animals; some are suspected of causing, or are known to cause, cancer in humans.

Wet-bulb temperature: The lowest air temperature that can be reached through evaporation at a specific air saturation point. Wet bulb and dry bulb temperatures will be identical at 100 % air saturation.

Zone: The occupied space or group of spaces within a building which has its heating or cooling controlled by a single thermostat.

Sources

From http://www.epa.gov/iaq/glossary.html
Used with permission from Heating, Ventilating, and Air Conditioning, 3rd Edition, Swanson, Don, American Technical Publishers, 2004.

From U.S. EPA, "Building Air Quality: A Guide for Building Owners and Facility Managers," 1991.

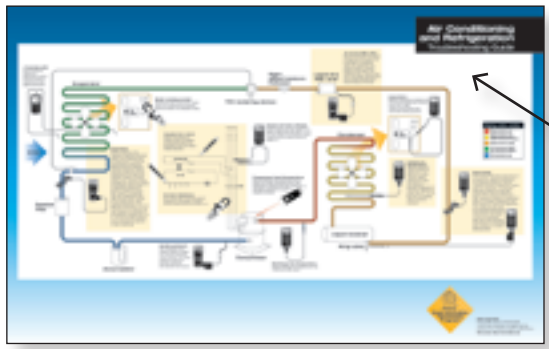
Resource gallery

We at Fluke understand how much you are being asked to do, and how challenging staying up to date on the industry, the tools, and your job can be. We've created resource centers which are a library of application notes, case studies and programs all designed with the goal of helping you do your job better. These pages show some of the HVAC/IAQ materials we've created which you might find informative. Order them from the Fluke web site at **http://www.fluke.com/iaq** or request them from your local distributor.

922 airflow quick reference guide

HVAC/IAQ tool box	
Description	**Literature code**
Airflow quick reference guide	2806211
Cleanroom chart	2547978
Particle size chart	2534962
Pressure temperature chart	2114645
Airborne Respiratory Pathogen chart	2645772
Poster on commercial building cut-away	2693496
Hospital IAQ poster	2547991
Air conditioning and refrigeration troubleshooting guide poster	2114638
Heating system common test point poster	2114623
Ohm's law poster	2100120
Understanding Safety Categories Poster	2096630
Pressure Temperature Pocket Card	1265816

Building diagnostics poster



Air conditioning and refrigeration troubleshooting guide poster

Application notes	
Description	**Literature code**
Indoor air quality: Can your schools pass the test?	2519671
Airborne particle counters provide vital information for maintaining indoor air quality in healthcare facilities	2461172
Indoor Air Quality: New Fluke Tools promise to help diagnose and fix an ancient problem	2429205
Making the Numbers Add Up: Understanding Specifications and Performance of Indoor Air Quality Test Instruments	2722838
When Startup Inspections Pay Off for HVAC	2743037
Growing your business through indoor air quality particulate profiling	2457379
Evaluating Indoor Air Quality	2425967
Evaluating relative humidity: Key factors and measurements	2522930
Troubleshooting compressors and the HVAC/R refrigeration cycle for mechanical problems	2434058
Electrical safety for CIH professionals	2507362
Investigating residential humidity complaints	2524516
Fossil fuel heating equipment principles and troubleshooting techniques	2434064
ABCs of DMMs: Multimeter features and functions explained	1260898
Fundamental IAQ/HVAC measurements with the Fluke 975 AirMeter™	2802154
Measuring air velocity with the Fluke 975 AirMeter™ using the velocity probe	2786472

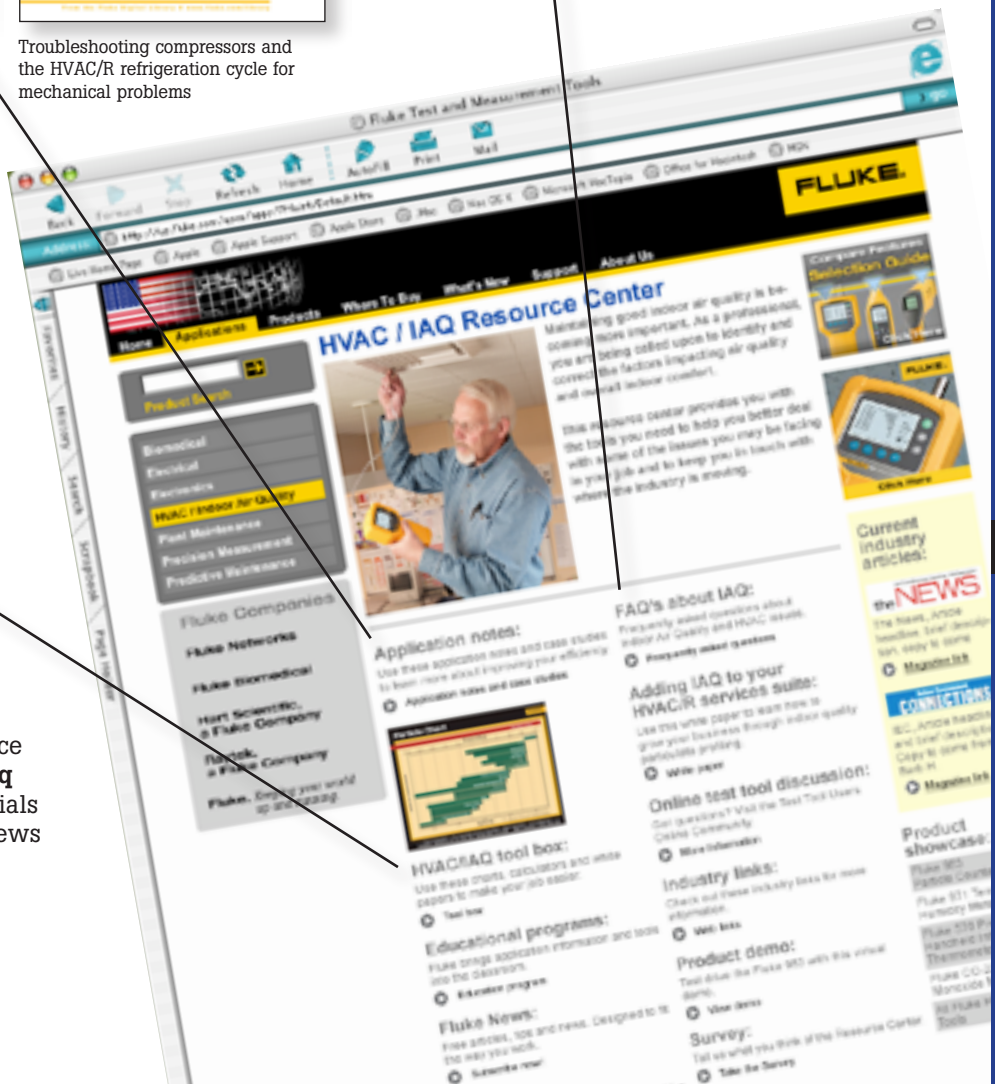
Particle size chart

Indoor air quality: Can your schools pass the test?

Investigating residential humidity complaints

Indoor Air Quality: New Fluke Tools promise to help diagnose and fix an ancient problem

Troubleshooting compressors and the HVAC/R refrigeration cycle for mechanical problems



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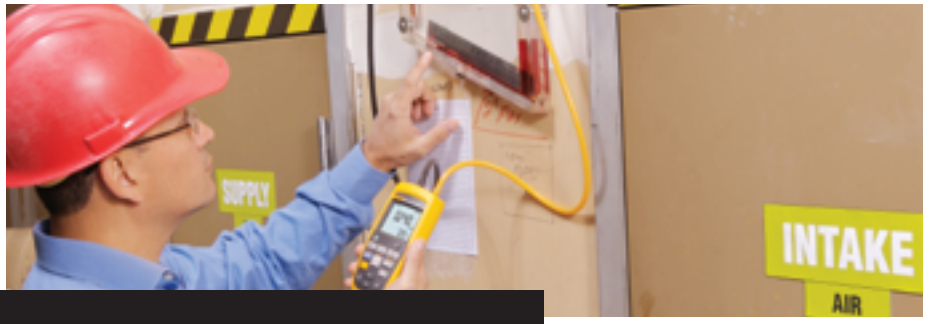
For more information, see page 6.



Fluke 922 Airflow Meter
For more information, see page 8.

Fluke IR InSight Infrared Imagers
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Fluke 561 HVACPro IR Thermometer
For more information, see page 14.

Fluke 902 True-rms HVAC Clamp
For more information, see page 21.

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